User Manual

IPM-4SE
4-Port E1 IP Multiplexer

LEGAL

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CISPR PUB.22 Class A COMPLIANCE:

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This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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Marking by the symbol CE indicates compliance of this equipment to the EMC and LVD directives of the European Community. Such marking is indicative that this equipment meets or exceeds the following technical standards: EN 55022:1994/A1:1995/A2:1997 Class A and EN61000-3-2:1995, EN61000-3-3:1995 and EN50082-1:1997

CTC Union Technologies Co., Ltd.
Far Eastern Vienna Technology Center (Neihu Technology Park)
8F, No. 60, Zhouzi St.
Neihu, Taipei, 114
Taiwan
Phone: +886-2-2659-1021
FAX: +886-2-2799-1355

IPM-4SE
4-Port E1 IP Multiplexer (TDM over IP)

User Manual
Version 0.9c March 16, 2011
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This manual supports the following models:
IPM-4SE AC
IPM-4SE DC

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Chapter 1. Introduction

1.1 Welcome

In telecommunications, TDM over IP (TDMoIP) is the emulation of time-division multiplexing (TDM) over a packet switched network (PSN). In the case of the IPM-4SE, TDM refers to E1 signals, while the PSN is based on Ethernet.

TDM over IP is a type of pseudo wire (PW). However, unlike other traffic types that can be carried over pseudo wires (e.g. ATM, Frame Relay, and Ethernet), TDM is a real-time bit stream, leading to TDM over IP having unique characteristics. In addition, conventional TDM networks have numerous special features, in particular those required in order to carry voice-grade telephony channels. These features imply signaling systems that support a wide range of telephony features, a rich standardization literature, and well-developed Operations and Management (OAM) mechanisms.

One critical issue in implementing TDM PWs is clock recovery. In native TDM networks the physical layer carries highly accurate timing information along with the TDM data which is easily recovered using phase-locked loop (PLL) techniques. However, when emulating TDM over PSNs this synchronization is absent. TDM timing standards can be exacting, and conformance with these may require innovative mechanisms to adaptively reproduce the TDM timing.

Another issue that must be addressed is TDM over IP packet loss concealment (PLC). Since TDM data is delivered at a constant rate over a dedicated channel, the native Ethernet network may have bit errors. All PSNs suffer to some degree from packet loss, and this must be compensated when delivering TDM over a PSN.

1.2 Product Description

The IPM-4SE series is a "Multi-service (TDM and Ethernet) Over LAN/MAN" bridge, which transports one, two, three, or four ports of ITU-T G.703 E1 and one LAN into Ethernet packets. Its target application shown in Figure 1.2 is the transparent E1 port interconnection via the Ethernet network (using Ethernet packets). Based upon RFC3916, the IPM-4SE series employs the latest Circuit Emulation System over packet technology.

The E1 over IP of IPM-4SE is compliant with IETF "CES over IP" standard. Versatile LEDs are provided for alarms and status indication.

1.3 Features

- Supports E1 (only) over 100M Ethernet to LAN/MAN.
- Provide one LAN for Ethernet access.
- User side provides standard PDH (E1 only) interfaces using balanced signals for twisted pair.
- Full-duplex 100M Ethernet Interface.
- Provides auto-negotiation which can auto configure 10/100M depending on the speed of LAN/MAN port.
- Supports "E1" Timing, i.e. LAN/MAN bandwidth requires at leased 5MHz or 10MHz.
- Provides "ACT" and "ALM" LED indicators for each PDH interface.
- Provides "Link status, Activity" LED indicators for 100M Ethernet interface.
- Stand–alone desktop unit, optional 19" rack mountable.
- Supports AC 100 ~ 240V input and optional DC -36 ~ -75V input for redundancy.
- **Important: T1(DS1) is currently not supported in this model**.

1.4 Physical Appearance

Figure 1.1 IPM-4SE 4-Port E1 Physical Appearance

Important: T1(DS1) is currently not supported in this model

1.5 IPM-4SE Application

The IPM-4SE is mainly applied for the solution of wire-line application connecting PSTN via E1 and Router via 100BaseTx and for integrating various equipments based on traditional TDM and popular IP services.
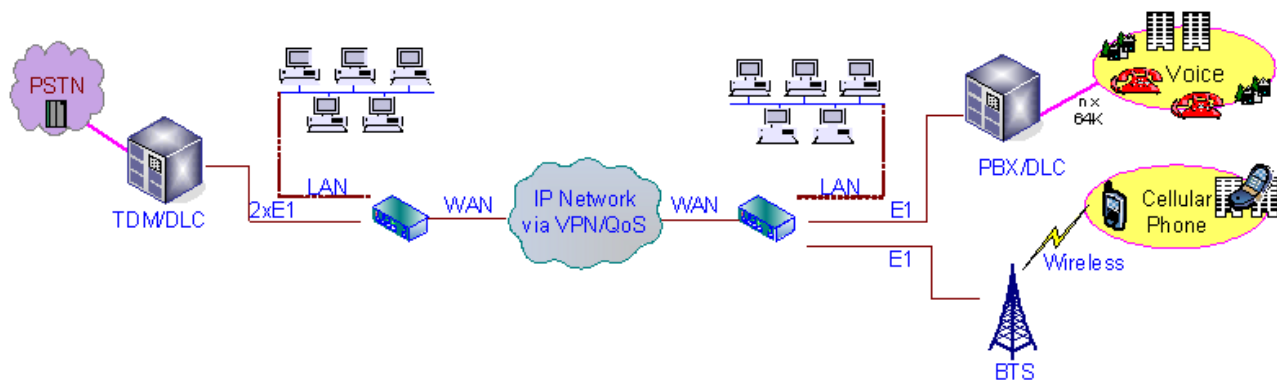
Figure 1.2 IPM-4SE 4-Port E1/T1 Application

1.6 IPM-4SE Specifications

100M Ethernet Interface
- Compliant with 802.3/802.3u standards
- 10/100-BaseT with RJ-45 connector
- Full-duplex
- Supports Auto-Negotiation per IEEE802.3u
- LED indicators for Ethernet: Link status and Activity

PDH Interfaces x 4
E1 Interface
        Data Rate: 2.048 Mbit/s ± 50 ppm
        Line Code: HDB3
        Impedance: 120 ohms ± 5% resistive, balanced.
        LED indications for E1: ACT, ALM
        Connector Type: RJ-45 per USOC RJ-48C (Rx pair 1&2; Tx pair 4&5)

Power Supply
AC: 100~240V ± 10%, 47 ~ 63Hz
(Optional) DC: -18 ~ -75 V
Power Consumption: less than 10W

Operating Environment
Ambient temperature: 0 ~ 40°C for indoor application
(Optional): 0 ~ 55°C
Storage temperature: 0 ~ 85°C
Relative humidity: 5 ~ 95% non condensing

Physical Dimension
Height: 44.5 mm (1U)
Width: 370 mm
Depth: 215 mm
Weight: 2 Kg (net)

Chapter 2. Installation

2.1 Introduction

The Installation chapter will cover the physical installation of the IPM-4SE, 4-Port E1 IP Multiplexer, the electrical connections, interface connections and cabling requirements. A brief overview of the functional components such as main unit and management options will also be outlined in this chapter.
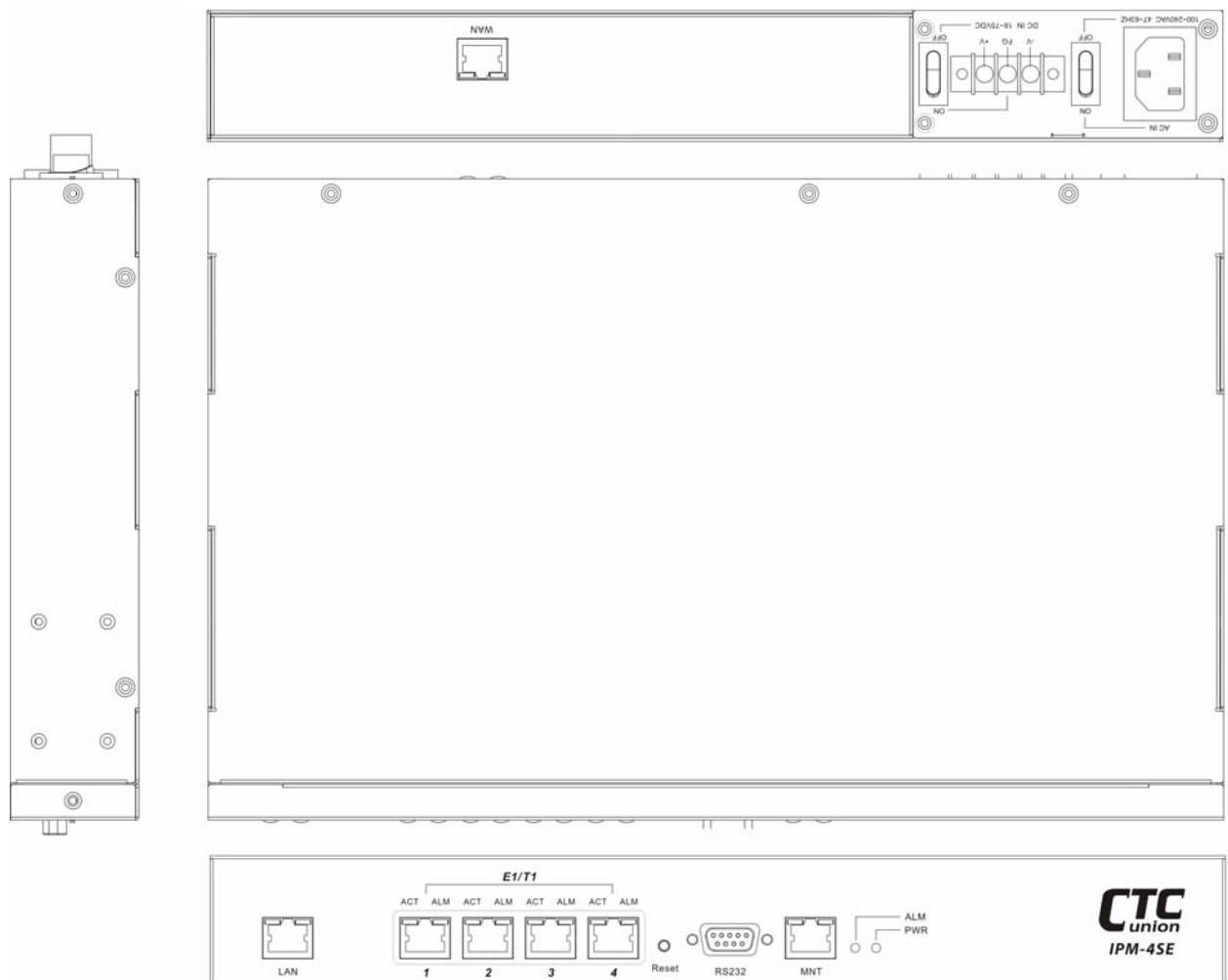
Required Tools
You will need these tools to install the IPM-4SE:
  Number 2 Phillips screwdriver for the 3mm and the 12-24 rack installation screws.
  Wrist strap or other personal grounding device to prevent ESD occurrences.
  Antistatic mat or antistatic foam to set the equipment on.

2.2 Unpacking

If there is a possibility for future relocation of the IPM-4SE unit, please keep the packing cartons and protection packaging materials. Carefully unpack and inspect the unit and accessories for potentially damaged or missing parts. Contact our nearest sales representative or our company directly if you detect any damaged or missing parts. Improper handling during shipment may cause early failure. Notify the shipper or forwarder immediately if the outer package shows signs of dropping or rough handling.

2.3 Site Preparation

Install the IPM-4SE within reach of an easily accessible grounded AC outlet or three wire (-48VDC, Power return, Earth Ground) central office power. The AC outlet should be capable of furnishing 90 to 250 VAC. Refer to 2.4 Electrical Installation. Allow at least 10cm (4 inch) clearance at the front of the IPM-4SE for the E1 and LAN copper cables.

2.4 Mechanical Assembly

The IPM-4SE is designed for desktop, shelf or rack mount installation and will require 1U space in a standard EIA 19" rack. The IPM-4SE chassis is delivered completely assembled upon delivery. The rack mount adapters may be placed along the front of the chassis as shown below.
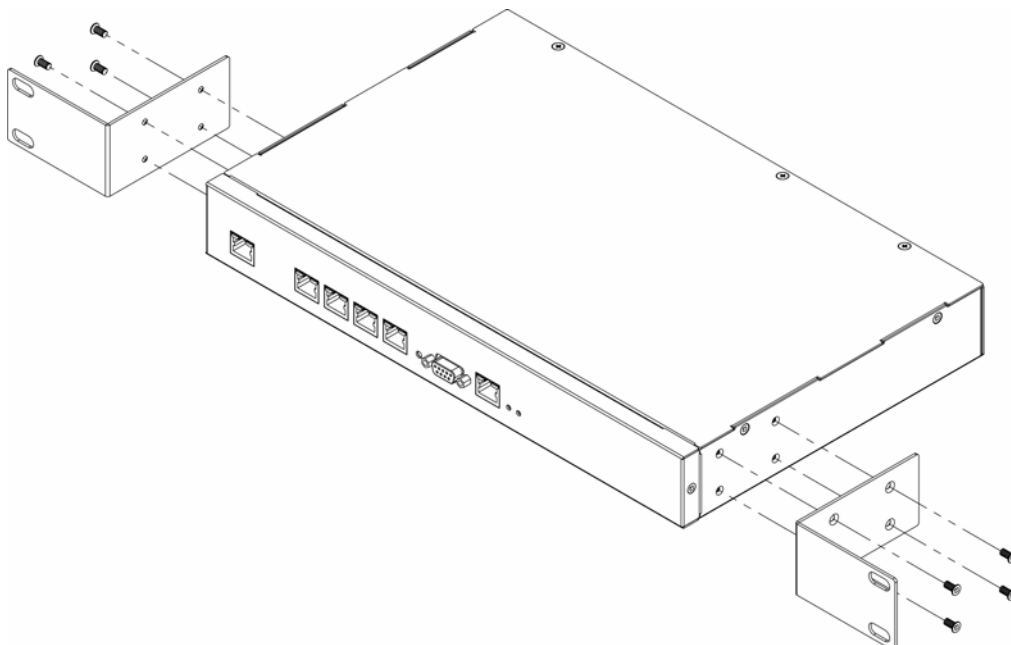

Figure 2.1 Standard 19" Rack-Mount Installation of IPM-4SE Unit requires 1RU space

2.5 Electrical Installation

With an AC power model, AC power is supplied to the IPM-4SE through a standard IEC C14 3-prong receptacle, located on the rear of the unit. Any national power cord with IEC C13 line plug may be used to connect AC power to the power module. With a DC model, DC -48V is connected to the terminal block located on the rear of the module, observing the proper polarity. The IPM-4SE should always be grounded through the protective earth lead of the power cable in AC installations, or via the frame ground connection for DC installations.

Left: Live line
Right: Neutral line
Middle: Ground

IEC C13 line plug

DC IN
-V   FG   +V

Left: -V (-48V)
Right: +V (0V)
Middle: Frame Ground

36~75VDC
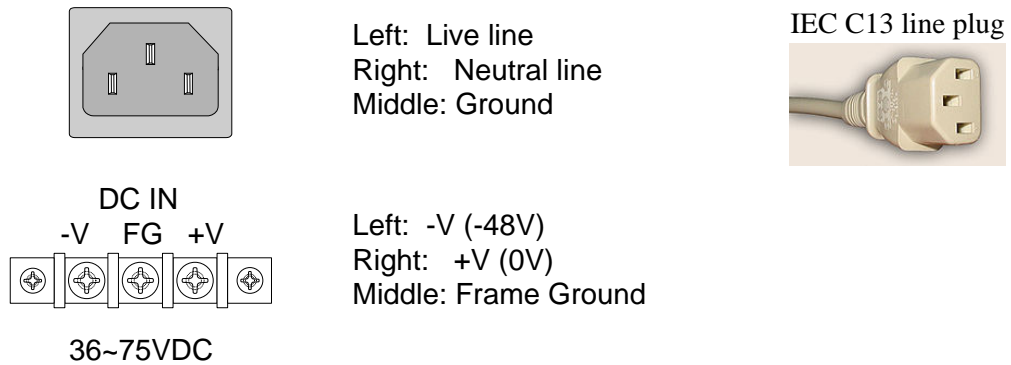
Figure 2.2 IEC (AC) & terminal block (DC) power connector pin assignment

2.6 Rack Installation

There are 3 common parts for each IPM-4SE package, including 1 set of TDM over IP multiplexer, 1 AC power cord. If the IPM-4SE is intended for mounting into a rack, a pair of L-type Steel brackets with 16 screws should be requested with the user's order. The user manual, an electronic PDF format file, will be included on a CD-ROM along with any accessory files such as SNMP MIB files and example script files. The following Figure 2.3 shows desktop or shelf operation and Figure 2.4 shows rack mounting of the IPM-4SE.
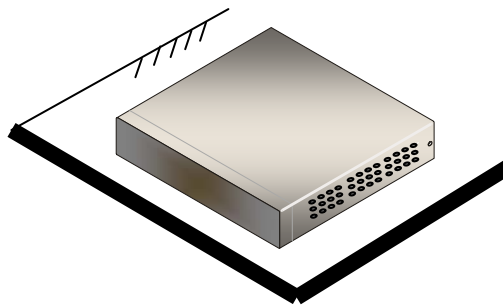
Figure 2.3 Stand-alone shelf or tabletop use

Rack Brackets

Figure 2.4 Rack mounted use

2.7 Basic Configuration and Diagnosis

The IPM-4SE units are shipped in pre-configured pairs. One is labeled CO (central office) and the other labeled CPE (customer premises equipment). Simply place the CO unit towards the E1 clock source (SDH multiplexer, BSC, carrier, etc.) and place the CPE unit connecting to the E1 recovery equipment (DSU/CSU, BTS, customer, etc.). After installing the device and powering on, if E1 transmission does not immediately work, follow the diagnostics and basic troubleshooting.

2.7.1 Utilize tools for diagnosis

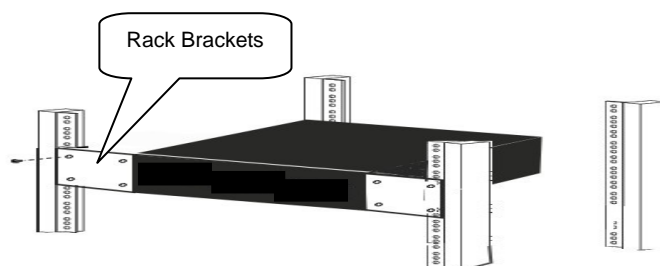- Maintain and troubleshoot the status from LED indications, shown below.
- Connect basic VT100 terminal to console port using 115.2K, 8bit, no parity, 1 stop bit no flow control
- Telnet NE using port 8888 to show the alarm or status if association still works.
- Associate NE via IPM-4SE GUI (tbd) to diagnose if configuration is correct and what status occurs.

2.7.2 Basic Troubleshooting

- If a ping of the remote NE via LAN/MAN does not respond, then please check the LAN connections and make sure Switch/LAN/MAN are working.
- If TDM or LAN provides unstable quality of service, please check the link performance or access port (E1/LAN) and reset the NE.

2.8 LED Indicators

LED Name	Light Status	Descriptions
PWR	Green	Power is on
ALM	Red	Raised from any PDH link alarms

Table 2.1 Chassis LED Indications of IPM-4SE

LED Name	Light Status	Descriptions
ACT	Green	E1 traffic is active (Ports 1~4)
ALM	Yellow	Raised from E1 link alarms (Ports 1~4)

Table 2.2 E1 LED Indications of IPM-4SE

LED Name	Light Status	Descriptions
Ethernet LINK	Green	Ethernet link is up
Ethernet ACT	Blinking Yellow	TX or RX Ethernet traffic is active

Table 2.3 MNT, LAN and WAN (RJ-45) LED Indications of IPM-4SE

Chapter 3. Configuration and Operation

3.1 Description

IPM-4SE consists of the front panel and the rear panel. The views and description of front and rear panels are shown in Figure 3.1 and 3.2.

The IPM-4SE units are shipped in pre-configured pairs. One is labeled **CO** (central office) and the other labeled **CPE** (customer premises equipment). Be sure to carefully check the model's sticker. Simply place the CO unit towards the E1 clock source (SDH multiplexer, BSC, carrier, etc.) and place the CPE unit connecting to the E1 recovery equipment (DSU/CSU, BTS, customer, etc.).

3.2 Front Panel Introduction

There are 6 items that need to be mentioned on the front panel of IPM-4SE.

3.2.1 System Indicators

PWR (Power Exist LED) Make sure power is available and switch is turned on
ALM (for any of E1 Links or WAN port Status)

3.2.2 Reset Button

Provides the facility of rebooting the system without powering off.

3.2.3 LAN & MNT Ethernet Connectors and Indicators

The Lan and MNT Ethernet interfaces use an RJ-45 connector with LED indicators
There are green and yellow LED indicators:
- Green Link (Link Up/Down Status)
- Yellow Act (TX/RX Active Status)

3.2.4 Alarm LED Display

E1/T1 Interface
- Green ACT (E1 Port Traffic)
- Yellow ALM (E1 Port Link Status)
The "RED" chassis LED indicates one of the following alarms occurred:
E1/T1 LOS, AIS, L-bit or no received traffic from WAN port

3.2.5 RS232 Connector

An RS232 interface with baud-rate 115200bps via DB9 (female)-to-DB9 (male) cable is provided for diagnostics. The user commands (CLI command) are listed in Table 3.1.

3.2.6 MNT Port (10/100M Ethernet Port for Telnet, or SNMP-based Management)

Provides a user management interface - Telnet or SNMP, via MNT port for managing the local & remote NEs.
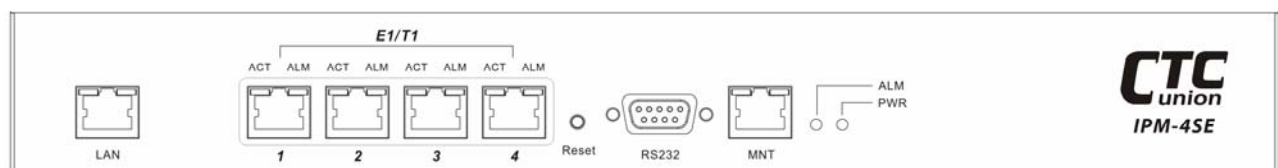

Figure 3.1 IPM-4SE 4-Port E1 Front Panel View

3.3 Rear Panel Introduction

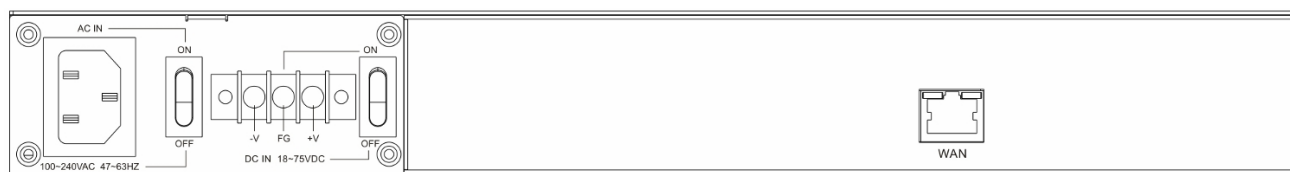There are three parts to the rear panel of the IPM-4SE, shown in Figure 3.2.

Figure 3.2 IPM-4SE 4-Port E1/T1 Rear Panel View

3.3.1 WAN Interface:

The Ethernet WAN interface is an RJ-45 connector with LED
There are green and yellow LED indicators:
- Green Link (Link Up/Down Status)
- Yellow Act (TX/RX Active Status)

3.3.2 AC Power Socket and Switch (On/Off switch for AC):

The power socket provides the power with an input range of AC 110 ~ 240V via standard IEC connector.

3.3.3 DC Power Socket and Switch (On/Off switch for DC):

The power terminal strip provides the power with an input range of DC -75 ~ -36V

3.4 Loopback Mode

The IPM-4SE provides two types of loopback: "E1 Remote Loopback" and "E1 Local Loopback". (Please refer to Figure 3.4).
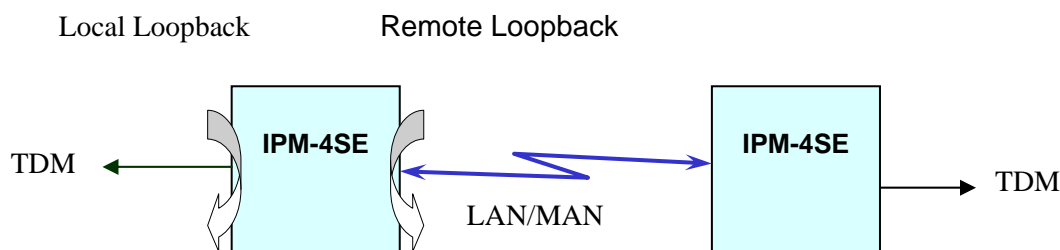
Figure 3.4 IPM-4SE E1 Loopback Mode

3.5 IP Configuration

The IP address, subnet mask address, and Gateway address of the management port (MNT) should be setup thru RS232 console using CLI commands.

3.6 Interface Configuration

For the LAN configuration, the setting of traffic bandwidth is provided to ensure the quality of service in TDM circuits with 16 throughput options of 50K, 100K, 150K, 200K, 250K, 300K, 350K, 400K, 800K, 1.6M, 3.2M, 6.4M, 12.8M, 25.6M, 51.2M and 100M, depending on the user's requirement. In addition, setting 100M option will utilize all the available bandwidth to LAN with no QoS for E1 traffic.

For the E1 configuration, the LEDs will be lit after enabling the E1 channel and user can select the remote output E1 channel for flexible cross connection purposes. A Jitter Buffer is also used to compensate for the latency of real network traffic between two devices. The Jitter buffer includes 8 options which are 11, 23, 40, 75, 99, 145, 192, and 239 ms.

3.7 Fault Report

The alarms/status of NE node can be reported thru RS232 or Telnet (CLI command). The resource of alarms is only from TDM interface (E1) and the acronym alarm names are shown as follows.

E1LOS: (E1 Loss of Signal) No E1 line connected to the specific E1 port.

E1AIS: (E1 Alarm Indication Signal) AIS (all 1's) signal input from the specific E1 port.

PWLBIT: (Pseudo Wire L bit) Remote E1 port failure condition (LOS or AIS).

PWRBIT: (Pseudo Wire R bit) Packet loss occurred at remote E1 port.

PWSEQNUMERR: (Pseudo Wire Sequence Number Error) Packet loss occurred for specific E1 local port.

JBUFEMP: (Jitter Buffer Empty) Buffer empty occurred at specific E1 port. (typically from link down or mis-configuration.) If link is good, increase the jitter buffer at the expense of latency.

JBUFOV: (Jitter Buffer Overflow) Buffer overflow occurred at specific E1 port. There is probably a problem with bi-direction throughput of the Ethernet WAN link.

3.8 Save Configuration

After changing the configurations from CLI or Telnet, the "SAVE" action should be done to store the configuration into non-volatile storage. This can avoid loosing settings if the device is rebooted or powered off/on.

3.9 Command Line Interface Setup

3.9.1 Using HyperTerminal™ as Local Console Terminal

When logging into the HyperTerm, set up the terminal port as follows:
- Bit rate: 115200bps
- Data bit: 8
- Parity: none
- Stop bit: 1
- Flow control: none
- Login password: **admin** (factory default)

3.9.2 Telnet in for Remote Console Terminal

If using the "Telnet" command in an Operation System, such as Windows or Linux, the default port of the IPM-4SE is 8888 instead of the standard port 23 for security issue. The default IP address of the management port is 192.168.1.1 and net mask is 255.255.255.0. The IP address, therefore, of the Telnet Client needs to be set in the IP range 192.168.1.2 to 192.168.1.254 and the same net mask. An example of a command line in Windows would be the following:
```
C:\WINDOWS\system32> telnet 192.168.1.1 8888
```

The factory default login password in both serial console CLI and Telnet modes is "admin". The CLI user commands are listed in the following table for detail and implemented on CLI and TELNET modes:

3.9.3 Setting CLI (Telnet) login password

Important: DO NOT FORGET the password once changed or you must return the unit to factory. There is no back-door password or any recovery procedure.

```
CLI> setpass c
===== Set Password for CLI Login =====
Enter Old Password: admin ==> OK!
Enter New Password: *** ==> OK!
Re-Enter New Password: *** ==> OK!
CLI>
```

CLI Command Descriptions

CLI Command	Descriptions
System Commands	
logout	Logout from the CLI System
cdisp	Display IPM-4SE current configurations.
csave	Save current configurations: IPM-4SE & relative settings.
cload	Load configuration setting from FLASH.
reboot	Reboot command to use after saving configuration
passwd	Enter password to change user-mode. (i.e. View/Setup/Admin mode) PS: If inputted password is not for "setup" or "admin", it will enter the "view" mode.
setpass mode	Modify password for user-mode. mode: 's' for setup mode, 'a' for admin mode.
ipset ip_addr net_mask gateway_ip	Set IPM-4SE IP address, net mask and gateway IP address. ip_addr: IP Address, net_mask: net mask, gateway_ip: gateway IP. EX: ipset 192.168.1.28 255.255.255.0 192.168.1.254
ipget	Get IPM-4SE current IP address, net mask, and gateway IP address.
trapset mode trap_ip_addr	Set SNMP Trap Mode & Host IP mode: 0 for disabling SNMP trap, 1 for enabling SNMP trap EX: trapset 1 192.168.6.3 (enables trap sending to 192.168.6.3 manager)
trapget	Get SNMP Trap Mode & Host IP
ntpset mode server_ip_addr	Set NTP Enable Mode & NTP Server IP mode: 0 for disable NTP function, 1 for enable NTP function
ntpget	Get NTP Enable Mode & NTP Server IP
upgrade server_ip file_name	Upgrade Software image file from TFTP server server_ip: TFTP server IP address file_name: SW image file name EX: upgrade 192.168.2.199 ipm130.bin
backup tftp_server_ip file_name	Backup the system configuration to TFTP server tftp_server_ip: the TFTP server IP address file_name: the backup file name EX: backup 192.168.2.199 ipm4se_co_backup_1
restore tftp_server_ip file_name	Restore the system configuration from TFTP server tftp_server_ip: the TFTP server IP address file_name: the backup file name EX: restore 192.168.2.199 ipm4se_co_backup_1
tgmode mode	Set TG Mode mode: 0 for Global mode, 1 for E1-Indep mode
ceschclkset ch_num clksrc	Set Channel Timing Gen Clock Source ch_no: E1 channel number. clksrc: 0:Adaptive (remote), 1:Internal, 2:E1 Recovery, 3:Bits.
tgpriset 1st.source 2nd.source	Set TG Clock Priority Source source: 0:Ext.BITS, 1:Global.TG, 2:HoldOver, 3:FreeRun
tge1loop e1_num	Set TG Secondary Clock Source Input e1_num: 1 ~4 for E1#1 ~ E1#4
tgget	Get TG Mode and Status
timeset hour min sec	Set current time with 'hour', 'minute' and 'second'.
dateset year month day	Set current date with 'year', 'mouth' and 'day'
timeget	Get current time and date
lpkset ch_no mode enable	Enable/Disable E1 channel loopback mode. ch_no: E1 channel number. mode: 0:Disable-All, 1:E1-Remote (FE), 2:E1-Local (NE) enable: 0:disable, 1:enable. EX: lpkset 1 1 1
lpkget	Get current loopback mode of E1 channel.
ping ip_addr	Use ICMP to check connection EX: ping 192.168.1.28

CLI Command	Descriptions
Provisioning Commands	
gci	Initialize GCI Middle Ware & CESoPSN chip Initialize relative Tasks, Messages and Semaphores. CAUTION: This will clear all the configuration.
cesopget	Get current CESoPSN Setting.
srcnet ip_addr net_mask gateway_ip	Set CESoPSN IP address, net mask and gateway IP address. ip_addr: IP Address, net_mask: net mask, gateway_ip: gateway IP. EX: srcnet 192.169.1.28 255.255.255.0 192.169.1.254
lanset enable bandwidth	Set CESoPSN LAN Traffic Enable and Bandwidth. enable: 0:disable, 1: enable. bandwidth: 0~15 (0: 50K, 1:100K, 2:150K, 3:200K, 4:250K, 5:300K, 6:350K, 7:400K, 8:800K, 9:1.6M, 10:3.125M, 11:6.25M, 12:12.5M, 13:25M, 14:50M, 15:100M) EX: lanset 1 15 (use the rest of BW minus TDM traffic)
vlanset enable	Set Vlan Mode enable/disable
ceschset ch_no enable dest_ip dest_mac	Set CESoPSN Channel Enable, Destination IP and MAC. ch_no: E1 channel number (1~4) enable: 0:disable, 1: enable. dest_ip: destination node IP address. dest_mac: destination node MAC address Situation 1: Set dest_ip, then get dest_mac from far end EX: ceschset 1 1 192.168.1.28 Situation 2: Set dest_ip and dest_mac manually EX: ceschset 1 1 192.168.1.28 AA:BB:CC:DD:EE:FF
cespwidset ch_no TrPWID PrPWID	Set CESoPSN Channel TrPWID and PrPWID. ch_no: E1 channel number (1~4) TrPWID: Transmit PseudoWire ID. PrPWID: Provision PseudoWire ID. EX: cespwidset 1 1 1
jitterbd ch_no depth	Set CESoPSN Channel Jitter Buffer Depth. Initial Jitter DS is 3. ch_no: E1 channel number (1~4) depth: jitter buffer depth 0~7 (0:11ms, 1:23ms, 2:40ms, 3:75ms, 4:99ms, 5:145ms, 6:192ms, 7:239ms) EX: jitterbd 1 2 (Suggested default is to set 40 ms for general uplink latency)
pktsize ch_no pkt_size	Set CESoPSN Channel Packet Size Pkt_size: 0: 1514 Byte, 1: 782 Byte, 2: 178 Byte. 3: 306 Byte.
cesfe1mode ch_no enable	
cesfe1crc ch_no enable	
cesfe1tsmap ch_no TsMap	
eberset ch_no enable threshold	Set CESoPSN EBER Enable and Threshold. ch_no: E1 channel number (1~4) enable: 0:disable, 1: enable. threshold: 0 ~ 3 (0:10^-3, 1:10^-4, 2:10^5, 3:10^-6)
ceschtgpriset ch_no 1st.source 2nd.source	Set CESoPSN Channel clock priority source in TG mode Source: 1:E1.TG, 2:HoldOver, 3:FreeRun.
ceschvlanvlpid ch_no vlp id	Set CESoPSN Channel vlan tag vlp:0 ~ 7, id: 0 ~ 0xFFF
eberget	Get CESoPSN EBER Enable and Threshold.
Alarm Command	
almall	Display all alarm status (CESoPSN)

Table 3.1 CLI Command Descriptions

3.10 Factory Default Scripts

When delivered from the factory, the units are paired as CO and CPE for immediate point-to-point use, with all 4 E1s enabled, unframed, and LAN enabled. Because these units operate at Ethernet Layer 2, we address the remotely connected pseudowire by MAC address.

If the device sticker has been lost, or if the MAC address has been inadvertently changed, the MAC for both the MNT port and WAN port can be viewed through the CLI. Below is an example.

3.10.1 Determine Device MAC Address

```
CLI>m 4321
====== CLI: MW Test Functions ======
m 4321 OUI(xx:xx:xx)
===== Config: HW/SW MAC = 1 (HW_MAC).
===== Config: OUI-Addr  = 00:02:AB.
===== Config: eth0 Addr = 00:02:AB:16:CD:13. <== this is NMS MAC Source
===== Config: eth1 Addr = 00:02:AB:16:CD:12. <== this is WAN MAC Source
```

3.10.2 CO Unit Factory Default Script

CO default, replace xx:xx:xx with CPE unit's unique MAC Address

```
gci
srcnet 172.16.1.1 255.255.255.0
ipset 192.168.1.11 255.255.255.0 172.16.1.2
ceschset 1 1 172.16.1.2 00:02:AB:xx:xx:xx
ceschset 2 1 172.16.1.2 00:02:AB:xx:xx:xx
ceschset 3 1 172.16.1.2 00:02:AB:xx:xx:xx
ceschset 4 1 172.16.1.2 00:02:AB:xx:xx:xx
cespwidset 1 1 1
cespwidset 2 2 2
cespwidset 3 3 3
cespwidset 4 4 4
pktsize 1 0
pktsize 2 0
pktsize 3 0
pktsize 4 0
jitterbd 1 1
jitterbd 2 1
jitterbd 3 1
jitterbd 4 1
ceschclkset 1 2
ceschclkset 2 2
ceschclkset 3 2
ceschclkset 4 2
lanset 1 7
csave
```

3.10.3 CPE Unit Factory Default Script

CPE default, replace xx:xx:xx with CO unit's unique MAC address

```
gci
srcnet 172.16.1.2 255.255.255.0
ipset 192.168.2.11 255.255.255.0 172.16.1.1
ceschset 1 1 172.16.1.1 00:02:AB:xx:xx:xx
ceschset 2 1 172.16.1.1 00:02:AB:xx:xx:xx
ceschset 3 1 172.16.1.1 00:02:AB:xx:xx:xx
ceschset 4 1 172.16.1.1 00:02:AB:xx:xx:xx
cespwidset 1 1 1
cespwidset 2 2 2
cespwidset 3 3 3
cespwidset 4 4 4
pktsize 1 0
pktsize 2 0
pktsize 3 0
pktsize 4 0
jitterbd 1 1
jitterbd 2 1
jitterbd 3 1
jitterbd 4 1
ceschclkset 1 0
ceschclkset 2 0
ceschclkset 3 0
ceschclkset 4 0
lanset 1 7
csave
```

The factory default scripts allow the units to connect with 4xE1 over any LAN environment. To quickly modify these two scripts for your LAN:
1. Change the 'srcnet' IP address to the new IP you want for the WAN port.
2. Change the 'ipset' to the IP, Subnet and GW for the MNT (management) port.
3. Change the 'ceschset' IP address to be the WAN destination for the PW (the opposite IPM)
4. Make sure the 'ceschset' MAC address is the actual MAC address of the destination unit (opposite IPM).

3.11 Application Examples

3.11.1 Point-to-Point with single E1 (port1) and LAN port active.

CO Side: (use the correct MAC address for the remote CPE unit)

```
gci
srcnet 172.16.1.1 255.255.255.0
ipset 192.168.1.11 255.255.255.0  172.16.1.2
ceschset 1 1 172.16.1.2 00:02:AB:xx:xx:xx
cespwidset 1 1 1
pktsize 1 0
jitterbd 1 1
ceschclkset 1 2
lanset 1 7
csave
```

CPE Side: (use the correct MAC address for the local CO unit)

```
gci
srcnet 172.16.1.2 255.255.255.0
ipset 192.168.2.11 255.255.255.0 172.16.1.1
ceschset 1 1 172.16.1.1 00:02:AB:xx:xx:xx
cespwidset 1 1 1
pktsize 1 0
jitterbd 1 1
ceschclkset 1 0
lanset 1 7
csave
```


3.11.2 Point-to-Point with Single E1 (port 1), Fractional /w CRC4 (nx64, n=8) active.

CO Side: (use the correct MAC address for the remote CPE unit)

```
gci
srcnet 172.16.1.1 255.255.255.0
ipset 192.168.1.11 255.255.255.0  172.16.1.2
ceschset 1 1 172.16.1.2 00:02:AB:xx:xx:xx
cespwidset 1 1 1
pktsize 1 0
jitterbd 1 1
ceschclkset 1 2
cesfe1mode 1 1
cesfe1crc 1 1
cesfe1tsmap 1 x000001FE
lanset 0
csave
```

CPE Side: (use the correct MAC address for the local CO unit)

```
gci
srcnet 172.16.1.2 255.255.255.0
ipset 192.168.2.11 255.255.255.0 172.16.1.1
ceschset 1 1 172.16.1.1 00:02:AB:xx:xx:xx
cespwidset 1 1 1
pktsize 1 0
jitterbd 1 1
ceschclkset 1 0
cesfe1mode 1 1
cesfe1crc 1 1
cesfe1tsmap 1 x000001FE
lanset 0
lanset 1 7
csave
```

3.11.3 Notes on Fractional E1 Operation

If IPM carries E1 as 'unframed', then it becomes transparent (SAToP). As long as the equipment on both sides of IPM equipment have the same framing, then there will be no alarms. However, the advantage of using framing (CESoPSN) is that the data bandwidth can be reduced considerably by sending only the payload, especially over a satellite link. You must make sure the right timeslots are enabled and match the crc4 if enabled or not (cesfe1crc). Duplicate these settings on both IPM4SE units.

For the hex to timeslot bit mask, each TS is represented by a bit:

```
TS bits : 11111111111111111111111111111111
TS #      33222222222211111111110000000000
 31~0     10987654321098765432109876543210
```

If we breakup into octets, then we can assign hex values:

```
1111|1111|1111|1111|1111|1111|1111|1111
  F |  F |  F |  F |  F |  F |  F |  F
```

So, if we want to enable fifteen timeslots, starting with TS1:

```
0000|0000|0000|0000|1111|1111|1111|1110
  0 |  0 |  0 |  0 |  F |  F |  F |  E
```

The `cesfe1tsmap` value would be `x0000FFFE`

If the timeslot range always starts at TS1, this table will work for you:

hex map no. of TS	x000001FE = 8	x0001FFFE = 16	x01FFFFFE = 24
x00000002 = 1	x000002FE = 9	x0002FFFE = 17	x02FFFFFE = 25
x00000006 = 2	x000006FE = 10	x0006FFFE = 18	x06FFFFFE = 26
x0000000E = 3	x00000FFE = 11	x000FFFFE = 19	x0FFFFFFE = 27
x0000001E = 4	x00001FFE = 12	x001FFFFE = 20	x1FFFFFFE = 28
x0000002E = 5	x00002FFE = 13	x002FFFFE = 21	x2FFFFFFE = 29
x0000006E = 6	x00006FFE = 14	x006FFFFE = 22	x6FFFFFFE = 30
x000000FE = 7	x0000FFFE = 15	x00FFFFFE = 23	xFFFFFFFE = 31

3.11.4 Using the IPM in a Routing Environment

The IPM-4SE is designed for use in an Ethernet environment (Layer 2). However, with proper configuration, the IPM-4SE will work in a routing environment. Knowing the Router MAC is the key. It is very easy to discover the router's MAC address. From a PC, open a command window, ping the gateway, then check the ARP table using the command *arp –a*. Make note of the gateway MAC on each subnet that has an IPM.

It is also very important to assign the right IP address to MNT port. The MNT port MUST be set to different subnet from WAN port. If the MNT port and WAN port are set to the same subnet, IPM-4 may not know where to route its packets, i.e., to the Router via MNT or WAN port. If it routes packets via MNT port, the CESoTDM packets will not be delivered to Router for forwarding to the remote side.
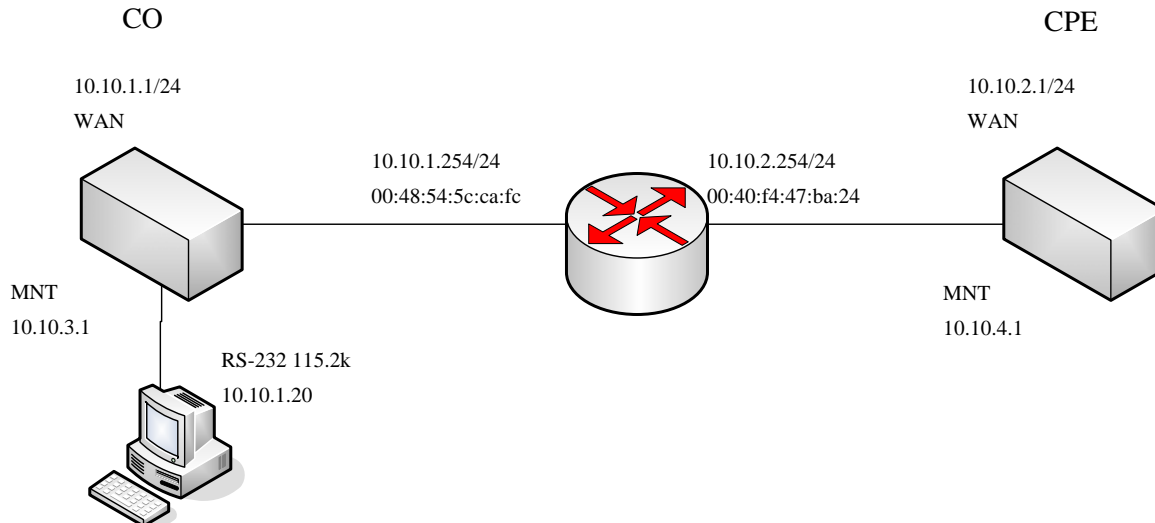
CO Side
```
CLI>m 4320 0 <== Set to SW MAC mode
CLI>csave
CLI>reboot
CLI>gci
CLI>srcnet 10.10.1.1 255.255.255.0 <== CO_Wan_IP Mask
CLI>ipset 10.10.3.1 255.255.255.0 10.10.1.254 <== MNT_IP Mask Default_GW
CLI>ceschset 1 1 10.10.2.1 00:48:54:5c:ca:fc <== ch_no en remote_ip GW_MAC
CLI>cespwidset 1 1 1
CLI>pktsize 1 1
CLI>jitterbd 1 1
CLI>ceschclkset 1 0
CLI>lanset 1 7
CLI>cs
```

CPE Side
```
CLI>m 4320 0
CLI>csave
CLI>reboot
CLI>gci
CLI>srcnet 10.10.2.1 255.255.255.0 <== CPE_Wan_IP Mask
CLI>ipset 10.10.4.1 255.255.255.0 10.10.2.254 <== MNT_IP Mask Default_GW
CLI>ceschset 1 1 10.10.1.1 00:40:f4:47:ba:24 <== ch_no en remote_ip GW_MAC
CLI>cespwidset 1 1 1
CLI>pktsize 1 1
CLI>jitterbd 1 1
CLI>ceschclkset 1 0
CLI>lanset 1 7
CLI>cs
```

Appendix

Abbreviations

AC	Alternating Current
AIS	Alarm Indication Signal
ANSI	American National Standards Institute
AP	Access Point
BITS	Building Integrated Timing Systems
BSC	Base Station Controller
BTS	Base Transceiver System
CESoPSN	Circuit Emulation Service over Packet Switch Network
CLI	Command Line Interface
CO	Central Office
CPE	Customer Premises Equipment
DC	Direct Current
DLC	Digital Loop Carrier
DSU/CSU	Digital Service Unit/Channel Service Unit
EIA	Electronic Industries Alliance
ESD	Electro-Static Discharge
FE	Fast Ethernet
FE1	Fractional E1
IEC	International Electrotechnical Commission
ITU	International Telecommunication Union
LAN	Local Area Network
LED	Light Emitting Diode
L-bit	Remote Defect Indication
LOS/LOF/PATH	Loss of Signal/Frame/Path Alarm
MAC	Media Access Control
MAN	Metro Area Network
MIB	Management Information Base
NE	Network Element
ODU	Out Door Unit
OOF	Out of Frame
PBX	Private Branch eXchange
PDF	Portable Document File
PDH	Plesiochronous Digital Hierarchy
POTS	Plain Old Telephone System
PSTN	Public Switched Telephone Network
PW	Pseudowire
QoS	Quality of Service
SAToP	Structure-Agnostic TDM over Packet
SDH	Synchronous Data Hierarchy
SNMP	Simple Network Management Protocol
TDM	Time Division Multiplexing
WAN	Wide Area Network

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T +886-2 2659-1021 **F** +886-2 2659-0237 **E** info@ctcu.com

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